

SEQUENCE LISTING

<110> Singletary, George  
Zhou, Lan

<120> Novel Starch Synthase Polynucleotides  
and Their Use in the Production of New Starches

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acc cca tgc tcc agc tac aat gga gct agt gat ttg gag ggt ttg gcc	219
Thr Pro Cys Ser Ser Tyr Asn Gly Ala Ser Asp Leu Glu Gly Leu Ala	
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ttc caa atc aga agg atc cct tat ctg agt aac cat gcc agt act ttt	267
Phe Gln Ile Arg Arg Ile Pro Tyr Leu Ser Asn His Ala Ser Thr Phe	
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gaa gga ctg aga tcg cggtt aac caa atg aat tca cgt cca atg cag tgt	315
Glu Gly Leu Arg Ser Arg Asn Gln Met Asn Ser Arg Pro Met Gln Cys	
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gca aag gca act act agg caa gtg agg aag gga atc caa cat gct agc	363
Ala Lys Ala Thr Thr Arg Gln Val Arg Lys Gly Ile Gln His Ala Ser	
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cga aga ccc tct gta atc tgt gca agt gga atg aac ttg atc ttt gtt	411
Arg Arg Pro Ser Val Ile Cys Ala Ser Gly Met Asn Leu Ile Phe Val	
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gct gct gag gtg gct ccg tgg agt aaa act gga ggg ctt ggt gat gtt	459
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ctt gga ggt ttg cca ccg gcc atg gcg gca aag gga cac agg gtg atg			507
Leu Gly Gly Leu Pro Pro Ala Met Ala Ala Lys Gly His Arg Val Met			
115	120	125	
act ata gca ccg cga cat gac caa tac aaa gat gga tgg gat acg gct			555
Thr Ile Ala Pro Arg His Asp Gln Tyr Lys Asp Gly Trp Asp Thr Ala			
130	135	140	
gtc ttt gtc gag ttg aaa gtt ggt gat aga att gaa act gtt cgc ttt			603
Val Phe Val Glu Leu Lys Val Gly Asp Arg Ile Glu Thr Val Arg Phe			
145	150	155	
tcc cac tgc tac aaa agg gga gtt gat cgg gtg ttt gtg gat cac cct			651
Phe His Cys Tyr Lys Arg Gly Val Asp Arg Val Phe Val Asp His Pro			
160	165	170	
ctc ttc ctt gag aag gtt tgg gga aaa act gga gga aag ata tat ggt			699
Leu Phe Leu Glu Lys Val Trp Gly Lys Thr Gly Gly Lys Ile Tyr Gly			
175	180	185	190
cct gtc aca aga act gat tat gaa gac aac cag cta agg ttc tgt ctt			747
Pro Val Thr Arg Thr Asp Tyr Glu Asp Asn Gln Leu Arg Phe Cys Leu			
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ctg tgt ttg gca act ctg gaa act cca agg gtt ctg aat ccc aac aat			795
Leu Cys Leu Ala Thr Leu Glu Thr Pro Arg Val Leu Asn Pro Asn Asn			
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Asn Lys Tyr His Ser Gly Pro Lys Gly Glu Asp Leu Phe Ile Ala Asn			
225	230	235	
gat tgg cat act gct cta tta cct tgc tat tta aag acc att gta tat			891
Asp Trp His Thr Ala Leu Leu Pro Cys Tyr Leu Lys Thr Ile Val Tyr			
240	245	250	
caa gcc cat gga ata tac aaa aat gct aaa gtt gct ttc tgc att cat			939
Gln Ala His Gly Ile Tyr Lys Asn Ala Lys Val Ala Phe Cys Ile His			
255	260	265	270
aat att gcg tat cag gga cgg ttt gcc ttt gaa gat ttt tcg cgt ctc			987
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Ala Lys Pro Ile Lys Gly Arg Lys Ile Asn Trp Met Lys Ala Gly Ile			
305	310	315	
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Ile Glu Ser Asp Arg Ala Leu Thr Val Ser Pro Tyr Tyr Ala Gln Glu			
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345	350		
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gga ctg ccc gtc aac agt aaa atc cct gtg ata gct ttc att ggc aga Gly Leu Pro Val Asn Ser Lys Ile Pro Val Ile Ala Phe Ile Gly Arg	400	405	1371
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425	430		
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475			
gcg ggt gct gat atc ctt gtt att ccc agt agg ttc gaa cca tgc ggt Ala Gly Ala Asp Ile Leu Val Ile Pro Ser Arg Phe Glu Pro Cys Gly	480	485	1611
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ctc att cag ctc cag ggc atg aga tac gga acc cct tcc atg tgc acc Leu Ile Gln Leu Gln Gly Met Arg Tyr Gly Thr Pro Ser Met Cys Thr	495	500	1659
505	510		
acg act ggt ggg ctc gtc gac act gtc aaa gaa ggc atc aca ggt ttc Thr Thr Gly Gly Leu Val Asp Thr Val Lys Glu Gly Ile Thr Gly Phe	515	520	1707
525			
cac atg ggt ccc ttc agt gtg gag tgc gac att gcc gac gag gcc gac His Met Gly Pro Phe Ser Val Glu Cys Asp Ile Ala Asp Glu Ala Asp	530	535	1755
540			
gtg cta aag att gtg gaa gca gtg aag aga gcc ctt atg gtt tat gga			1803

Val Leu Lys Ile Val Glu Ala Val Lys Arg Ala Leu Met Val Tyr Gly			
545	550	555	
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Thr Pro Ala Phe Glu Glu Met Ile Gln Asn Cys Met Ala Gln Asp Phe			
560	565	570	
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Ser Trp Lys Gly Pro Ala Lys Glu Trp Glu Lys Phe Leu Leu Ser Leu			
575	580	585	590
ggg ctc gag ggt agt gaa gct gga att gaa ggc gag gaa gta gct cct		1947	
Gly Leu Glu .Gly Ser Glu Ala Gly Ile Glu Gly Glu Glu Val Ala Pro			
595	600	605	
ctc gcc aag gaa aac gtg gcc act cca tgaaaactgat catcgagttg		1994	
Leu Ala Lys Glu Asn Val Ala Thr Pro			
610	615		
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35 40 45			
Leu Arg Ser Arg Asn Gln Met Asn Ser Arg Pro Met Gln Cys Ala Lys			
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Ala Thr Thr Arg Gln Val Arg Lys Gly Ile Gln His Ala Ser Arg Arg			
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Pro Ser Val Ile Cys Ala Ser Gly Met Asn Leu Ile Phe Val Ala Ala			
85 90 95			
Glu Val Ala Pro Trp Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly			
100 105 110			
Gly Leu Pro Pro Ala Met Ala Ala Lys Gly His Arg Val Met Thr Ile			
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Ala Pro Arg His Asp Gln Tyr Lys Asp Gly Trp Asp Thr Ala Val Phe			
130 135 140			
Val Glu Leu Lys Val Gly Asp Arg Ile Glu Thr Val Arg Phe Phe His			
145 150 155 160			
Cys Tyr Lys Arg Gly Val Asp Arg Val Phe Val Asp His Pro Leu Phe			
165 170 175			
Leu Glu Lys Val Trp Gly Lys Thr Gly Gly Lys Ile Tyr Gly Pro Val			
180 185 190			
Thr Arg Thr Asp Tyr Glu Asp Asn Gln Leu Arg Phe Cys Leu Leu Cys			
195 200 205			

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 Tyr His Ser Gly Pro Lys Gly Glu Asp Leu Phe Ile Ala Asn Asp Trp  
 225 230 235 240  
 His Thr Ala Leu Leu Pro Cys Tyr Leu Lys Thr Ile Val Tyr Gln Ala  
 245 250 255  
 His Gly Ile Tyr Lys Asn Ala Lys Val Ala Phe Cys Ile His Asn Ile  
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 Pro Asp Thr Phe Lys Ser Ser Phe Asp Phe Ile Asp Gly Tyr Ala Lys  
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 Ser Asp Arg Ala Leu Thr Val Ser Pro Tyr Tyr Ala Gln Glu Leu Val  
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 Ser Gly Ile Asp Lys Gly Val Glu Leu Asp Asn Ile Leu Arg Leu Lys  
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 Thr Ile Cys Gly Ile Ile Asn Gly Met Asp Thr Asn Glu Trp Asn Pro  
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 Ser Thr Asp Lys Tyr Ile Thr Ala Asn Tyr Asp Ala Thr Thr Val Met  
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 Ala Asp Ile Leu Val Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu Ile  
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 Gln Leu Gln Gly Met Arg Tyr Gly Thr Pro Ser Met Cys Thr Thr Thr  
 500 505 510  
 Gly Gly Leu Val Asp Thr Val Lys Glu Gly Ile Thr Gly Phe His Met  
 515 520 525  
 Gly Pro Phe Ser Val Glu Cys Asp Ile Ala Asp Glu Ala Asp Val Leu  
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 Lys Ile Val Glu Ala Val Lys Arg Ala Leu Met Val Tyr Gly Thr Pro  
 545 550 555 560  
 Ala Phe Glu Glu Met Ile Gln Asn Cys Met Ala Gln Asp Phe Ser Trp  
 565 570 575  
 Lys Gly Pro Ala Lys Glu Trp Glu Lys Phe Leu Leu Ser Leu Gly Leu  
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53

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Ser Ser Pro Pro Ala Pro Pro Pro Gly Ala Ala Ser Cys Arg Leu  
10 15 20

101

ctg cac ggc ggg gct cgc cct ctt ggc cac tct ccg ctt tgc tgg gcg  
Leu His Gly Gly Ala Arg Pro Leu Gly His Ser Pro Leu Cys Trp Ala  
25 30 35

149

aat cct ctc tgt acg agc cga ttt atg gcg ggt ctt tca gaa gtc aag  
Asn Pro Leu Cys Thr Ser Arg Phe Met Ala Gly Leu Ser Glu Val Lys  
40 45 50

197

aaa ggg agc aaa atc aca ctc aaa cat atc gat cac act gga agt gct  
Lys Gly Ser Lys Ile Thr Leu Lys His Ile Asp His Thr Gly Ser Ala  
55 60 65 70

245

cgc aca atg agg ttt ctt aat gct tta tac cat gga caa tca gcg gat  
Arg Thr Met Arg Phe Leu Asn Ala Leu Tyr His Gly Gln Ser Ala Asp  
75 80 85

293

cta gtt cca atc aac cac agg gga aag tct tca ggc gca gtt ggg aga  
Leu Val Pro Ile Asn His Arg Gly Lys Ser Ser Gly Ala Val Gly Arg  
90 95 100

341

agc aat att aat gat ata caa gag gat agc aat caa gat gtt gac att  
Ser Asn Ile Asn Asp Ile Gln Glu Asp Ser Asn Gln Asp Val Asp Ile  
105 110 115

389

gcc gat gat tct gtt gca caa aca atg gaa caa agc aag aag gtg ttg

437

Ala Asp Asp Ser Val Ala Gln Thr Met Glu Gln Ser Lys Lys Val Leu			
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gaa atg cag agg aac ctg ctg caa cag att att gaa aag aga aat ttc			485
Glu Met Gln Arg Asn Leu Leu Gln Gln Ile Ile Glu Lys Arg Asn Phe			
135	140	145	150
tct gaa gag aca gaa tct tat gtc aag aaa gat gag aac ctt gga att			533
Ser Glu Glu Thr Glu Ser Tyr Val Lys Lys Asp Glu Asn Leu Gly Ile			
155	160	165	
tat gca gaa gca tat atg caa acc tca aac aat caa caa gaa gct cca			581
Tyr Ala Glu Ala Tyr Met Gln Thr Ser Asn Asn Gln Gln Glu Ala Pro			
170	175	180	
cca gaa gaa gga aat ctg aac tct cct cct ttg gct ggt cca aat gta			629
Pro Glu Glu Gly Asn Leu Asn Ser Pro Pro Leu Ala Gly Pro Asn Val			
185	190	195	
atg aat atc ata ttg gta gct gca gaa tgt gca cca tgg tct aaa aca			677
Met Asn Ile Ile Leu Val Ala Ala Glu Cys Ala Pro Trp Ser Lys Thr			
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ggg ggg ctt gga gat gtt gtt gga gct tta cct aaa gca ttg gcc aag			725
Gly Gly Leu Gly Asp Val Val Gly Ala Leu Pro Lys Ala Leu Ala Lys			
215	220	225	230
aga gga cat cgt gtc atg gta gtg tct cca aga tat gga aac tat cct			773
Arg Gly His Arg Val Met Val Val Ser Pro Arg Tyr Gly Asn Tyr Pro			
235	240	245	
gaa cct aag gaa ata ggg aat ctt aaa agg tac aag gtt gat gga cag			821
Glu Pro Lys Glu Ile Gly Asn Leu Lys Arg Tyr Lys Val Asp Gly Gln			
250	255	260	
gac atg gag att aaa tac tat cat act tac atc gat tct gtt gat ttt			869
Asp Met Glu Ile Lys Tyr Tyr His Thr Tyr Ile Asp Ser Val Asp Phe			
265	270	275	
gtc ttc atc gat agt cct att ttc cgc cat att gga aat gat ata tat			917
Val Phe Ile Asp Ser Pro Ile Phe Arg His Ile Gly Asn Asp Ile Tyr			
280	285	290	
ggg gga aac cga gtg gac att ttg aag aga atg gta ttg ttc tgc aaa			965
Gly Gly Asn Arg Val Asp Ile Leu Lys Arg Met Val Leu Phe Cys Lys			
295	300	305	310
gca gca gtt gag gtt cct tgg cat gtc cca tgt ggt gga ttc tgt tat			1013
Ala Ala Val Glu Val Pro Trp His Val Pro Cys Gly Phe Cys Tyr			
315	320	325	
gga gat ggg aat ttg gtt ttc att gcc aac gat tgg cat acc tcc tta			1061
Gly Asp Gly Asn Leu Val Phe Ile Ala Asn Asp Trp His Thr Ser Leu			
330	335	340	
ctt cca gtt tat ttg aag gca tgt ttc cgt gat cgt gga tta atg aca			1109

Leu Pro Val Tyr Leu Lys Ala Cys Phe Arg Asp Arg Gly Leu Met Thr			
345	350	355	
tac gct cgc tgt ctc ttg gtt att cac aac att gca cat cag ggt cgt Tyr Ala Arg Cys Leu Leu Val Ile His Asn Ile Ala His Gln Gly Arg		1157	
360	365	370	
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375	380	385	390
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455	460	465	470
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475	480	485	
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490	495	500	
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535	540	545	550
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555	560	565	
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Phe Ser Val Lys Met Ala His Arg Ile Thr Ala Gly Ala Asp Ala Leu  
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Leu Met Pro Ser Arg Phe Glu Pro Cys Gly Leu Asn Gln Leu His Ala  
585 590 595

atg atg tac gga aca att cct gtt gtg cat gca gta ggt ggt ctt cga 1877  
Met Met Tyr Gly Thr Ile Pro Val Val His Ala Val Gly Gly Leu Arg  
600 605 610

gat act gtg caa cag ttt gat ccg ttc aat gag aca ggt ttg gga tgg 1925  
Asp Thr Val Gln Gln Phe Asp Pro Phe Asn Glu Thr Gly Leu Gly Trp  
615 620 625 630

acc ttt gac agg gca gag gca cat agg atg ata gtg gca ctc ggc cat 1973  
Thr Phe Asp Arg Ala Glu Ala His Arg Met Ile Val Ala Leu Gly His  
635 640 645

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Cys Leu Asn Thr Tyr Arg Asn Tyr Lys Glu Ser Trp Val Gly Leu Gln  
650 655 660

aag cga ggg atg atg cag gac ctc agt tgg gag agt gct gcc gag cac 2069  
Lys Arg Gly Met Met Gln Asp Leu Ser Trp Glu Ser Ala Ala Glu His  
665 670 675

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Tyr Glu Lys Val Leu Val Ala Ala Lys Tyr Gln Trp  
680 685 690

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20 25 30  
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35 40 45  
Gly Leu Ser Glu Val Lys Lys Gly Ser Lys Ile Thr Leu Lys His Ile  
50 55 60  
Asp His Thr Gly Ser Ala Arg Thr Met Arg Phe Leu Asn Ala Leu Tyr  
65 70 75 80  
His Gly Gln Ser Ala Asp Leu Val Pro Ile Asn His Arg Gly Lys Ser  
85 90 95  
Ser Gly Ala Val Gly Arg Ser Asn Ile Asn Asp Ile Gln Glu Asp Ser  
100 105 110

Asn Gln Asp Val Asp Ile Ala Asp Asp Ser Val Ala Gln Thr Met Glu  
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 Gln Ser Lys Lys Val Leu Glu Met Gln Arg Asn Leu Leu Gln Gln Ile  
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 Ile Glu Lys Arg Asn Phe Ser Glu Glu Thr Glu Ser Tyr Val Lys Lys  
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 Asp Glu Asn Leu Gly Ile Tyr Ala Glu Ala Tyr Met Gln Thr Ser Asn  
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 Asn Gln Gln Glu Ala Pro Pro Glu Glu Gly Asn Leu Asn Ser Pro Pro  
     180                     185                     190  
 Leu Ala Gly Pro Asn Val Met Asn Ile Ile Leu Val Ala Ala Glu Cys  
     195                     200                     205  
 Ala Pro Trp Ser Lys Thr Gly Gly Leu Gly Asp Val Val Gly Ala Leu  
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 Pro Lys Ala Leu Ala Lys Arg Gly His Arg Val Met Val Val Ser Pro  
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 Arg Tyr Gly Asn Tyr Pro Glu Pro Lys Glu Ile Gly Asn Leu Lys Arg  
     245                     250                     255  
 Tyr Lys Val Asp Gly Gln Asp Met Glu Ile Lys Tyr Tyr His Thr Tyr  
     260                     265                     270  
 Ile Asp Ser Val Asp Phe Val Phe Ile Asp Ser Pro Ile Phe Arg His  
     275                     280                     285  
 Ile Gly Asn Asp Ile Tyr Gly Gly Asn Arg Val Asp Ile Leu Lys Arg  
     290                     295                     300  
 Met Val Leu Phe Cys Lys Ala Ala Val Glu Val Pro Trp His Val Pro  
     305                     310                     315                     320  
 Cys Gly Gly Phe Cys Tyr Gly Asp Gly Asn Leu Val Phe Ile Ala Asn  
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 Asp Trp His Thr Ser Leu Leu Pro Val Tyr Leu Lys Ala Cys Phe Arg  
     340                     345                     350  
 Asp Arg Gly Leu Met Thr Tyr Ala Arg Cys Leu Leu Val Ile His Asn  
     355                     360                     365  
 Ile Ala His Gln Gly Arg Gly Pro Leu Asp Asp Phe Ser Tyr Val Asp  
     370                     375                     380  
 Leu Pro His Asp His Ile Asp Ser Phe Arg Leu Asp Asp Pro Val Gly  
     385                     390                     395                     400  
 Gly Glu His Phe Asn Ile Phe Ala Ala Gly Ile Arg Ala Ala Asp Arg  
     405                     410                     415  
 Val Val Thr Val Ser His Gly Tyr Ala Trp Glu Leu Lys Thr Ser Glu  
     420                     425                     430  
 Gly Gly Trp Gly Leu His Glu Ile Ile Asn Glu Cys His Trp Lys Phe  
     435                     440                     445  
 His Gly Ile Val Asn Gly Ile Asp Thr His Ser Trp Asn Pro Lys Phe  
     450                     455                     460  
 Asp Ala His Leu Asn Ser Asp Gly Tyr Thr Asn Phe Thr Leu Glu Thr  
     465                     470                     475                     480  
 Leu Glu Met Gly Lys Ala Gln Cys Lys Ala Ala Leu Gln Arg Glu Phe  
     485                     490                     495  
 Gly Leu Pro Val Arg Asp Asp Val Pro Ile Leu Ala Phe Ile Gly Arg  
     500                     505                     510  
 Leu Asp His Gln Lys Gly Ile Asp Leu Ile Ala Glu Ala Met His Trp  
     515                     520                     525  
 Leu Val Gly Gln Asp Leu Gln Ile Ile Met Leu Gly Thr Gly Arg Pro  
     530                     535                     540  
 Asp Leu Glu Asp Met Leu Arg Arg Phe Glu Arg Glu His Arg Gly Lys  
     545                     550                     555                     560

Val Arg Gly Trp Val Gly Phe Ser Val Lys Met Ala His Arg Ile Thr  
               565                  570                  575  
 Ala Gly Ala Asp Ala Leu Leu Met Pro Ser Arg Phe Glu Pro Cys Gly  
               580                  585                  590  
 Leu Asn Gln Leu His Ala Met Met Tyr Gly Thr Ile Pro Val Val His  
               595                  600                  605  
 Ala Val Gly Gly Leu Arg Asp Thr Val Gln Gln Phe Asp Pro Phe Asn  
               610                  615                  620  
 Glu Thr Gly Leu Gly Trp Thr Phe Asp Arg Ala Glu Ala His Arg Met  
               625                  630                  635                  640  
 Ile Val Ala Leu Gly His Cys Leu Asn Thr Tyr Arg Asn Tyr Lys Glu  
               645                  650                  655  
 Ser Trp Val Gly Leu Gln Lys Arg Gly Met Met Gln Asp Leu Ser Trp  
               660                  665                  670  
 Glu Ser Ala Ala Glu His Tyr Glu Lys Val Leu Val Ala Ala Lys Tyr  
               675                  680                  685  
 Gln Trp  
               690

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 <213> Curcuma zedoaria

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25

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<400> 8  
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25

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 agcactcatt cacatagcaa cagtgatagt gaatctctgg aagcttagtc tgctgggttc  
 tcaaacacag gccaaaattc tctatcaagc catgatgatg atggtgatata tattaggaag  
 acagatgtgg cagtatcatc tgatgaagaa agtaatagtg tgattggag tgtagtcaga  
 ggggagcattc caagcattcg tcttgaggac ttgatagcta tggtcacaaa tgctaaaaaa  
 agtagttata tttgttttc catgtaaaac tgttacttct caatctttt atctacccat  
 gatatgtttt ttagatactt tgcttcttaa tcaagctcg gttcgtgcac ttgaagaact  
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 gttggcagaa acagatgcac gtattaaagc tgcaagctcaa gaaaagatca atgtggaaact  
 ccttgaagat cagatggagc agttgaagaa tgaaaatgcct tcaaggaatt ctattgaagg  
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aagagaaaat tcaatgctaa aaagtatat acagactttt aagatgaaac taactgatgt	720		
tagtggaaaca gaggaccgtg tgcataact agagaaaagaa tggatgattt	780		
cctaaaaat ttgcaacgtc agtttgcac ttttgatgtt tccaaacttg attccctgca	840		
atataatgc agggcttgc cagacaaggtaat aatgcatttataat cagtgaaacaa	900		
tgggtttgtat gtgccttcgt taagtttaca acaatataat gaactggaga agaagggtgc	960		
taagtttagag gcatctatga tggaaagagaa ggtgc当地 gttccc当地 aaacatttca	1020		
ccattatgaa cagatttctac aacagaaaat tgagagctt gaggagcgc当地 tacaagggtgc	1080		
tgtatcaaaaa atgaatttgc aaatttcaatt gttccaggaa tcagtttagac aatttcaggaa	1140		
tacacttgc aagctatgc aagaatttgc caaaaatca cgtgaaactt tgctggaaaa	1200		
tgtacccgttgc gatgttgc gcttctaatt gatgggttgc tgctcgagaa	1260		
gaagatatac tcaatgtatgc ctaatttgc gagagaatttgc acgtggaaaa aggg atg	1317		
	Met		
	1		
 ctc gaa tcc atg atg cat att tgg cct cta aga aca aaa gtg agc ctg	1365		
Leu Glu Ser Met Met His Ile Trp Pro Leu Arg Thr Lys Val Ser Leu			
5	10	15	
 aaa gat tgg cta cat ttc tca agg tta ctt cct tct cat gca agt gta	1413		
Lys Asp Trp Leu His Phe Ser Arg Leu Leu Pro Ser His Ala Ser Val			
20	25	30	
 gga ttg cac ata tcc cat att gcc gca gaa atg gct cca att gca aag	1461		
Gly Leu His Ile Ser His Ile Ala Ala Glu Met Ala Pro Ile Ala Lys			
35	40	45	
 gtt ggc ggt tta gga gat gtt gta tct ggt ctt tgc aaa gcg ttg cag	1509		
Val Gly Gly Leu Asp Val Val Ser Gly Leu Cys Lys Ala Leu Gln			
50	55	60	65
 agg aag gga cac ttg gtg gaa att gtc ctt cca aaa tat gat tgt atg	1557		
Arg Lys Gly His Leu Val Glu Ile Val Leu Pro Lys Tyr Asp Cys Met			
70	75	80	
 cag tat gat ctt gtt cct gat ctg agg gta ttg gat gtt gca gta gag	1605		
Gln Tyr Asp Leu Val Pro Asp Leu Arg Val Leu Asp Val Ala Val Glu			
85	90	95	
 tct tat ttt gat gga caa tta ttc aag aat aaa att tgg gtt gcg gct	1653		
Ser Tyr Phe Asp Gly Gln Leu Phe Lys Asn Lys Ile Trp Val Ala Ala			
100	105	110	
 gta gaa ggt ctt cct gtt tac ttt ata gag cct cat cat cca gac aag	1701		
Val Glu Gly Leu Pro Val Tyr Phe Ile Glu Pro His His Pro Asp Lys			
115	120	125	
 ctc ttc tgg aga gga aaa tac tat gga gaa cat gat gac ttc aaa cgc	1749		
Leu Phe Trp Arg Gly Lys Tyr Tyr Gly Glu His Asp Asp Phe Lys Arg			
130	135	140	145
 ttt tca ttt ttt agc cgt gct gct ctt gaa tta ctc tat caa gct ggg	1797		
Phe Ser Phe Phe Ser Arg Ala Ala Leu Glu Leu Leu Tyr Gln Ala Gly			
150	155	160	
 aag aaa cct gac ata att cat tgt cat gat tgg cag aca gcc ttt gtt	1845		
Lys Lys Pro Asp Ile Ile His Cys His Asp Trp Gln Thr Ala Phe Val			

165

170

175

gca cca ctt tac tgg gat ata tat gct aac aaa ggc tta aat tca gct Ala Pro Leu Tyr Trp Asp Ile Tyr Ala Asn Lys Gly Leu Asn Ser Ala 180	185	190	1893
aga att tgc ttt acc tgc cac aac ttt gag cat cag gga att ata cct Arg Ile Cys Phe Thr Cys His Asn Phe Glu His Gln Gly Ile Ile Pro 195	200	205	1941
gct tca gcc ttg gca tcc tgt ggt ttt gat gtc cat cat atg aac aga Ala Ser Ala Leu Ala Ser Cys Gly Phe Asp Val His His Met Asn Arg 210	215	220	225
gat cga atg cag gac aat tca gcg cat gac aga gtc aat gtt gtt aag Asp Arg Met Gln Asp Asn Ser Ala His Asp Arg Val Asn Val Val Lys 230	235	240	2037
ggt gca att gtg ttc tct aac att gtt act acc gta tca cca act tat Gly Ala Ile Val Phe Ser Asn Ile Val Thr Thr Val Ser Pro Thr Tyr 245	250	255	2085
gct caa gag gcg tgc act gca gag ggt ggt cggt ggc cta cac gaa aca Ala Gln Glu Ala Cys Thr Ala Glu Gly Arg Gly Leu His Glu Thr 260	265	270	2133
tta cag tca ttt tcg aag aaa ttt gtg ggg att ctt aat ggc att gat Leu Gln Ser Phe Ser Lys Lys Phe Val Gly Ile Leu Asn Gly Ile Asp 275	280	285	2181
gct gat gca tgg aat cct tca act gat aaa tat atc agt gtt cag tat Ala Asp Ala Trp Asn Pro Ser Thr Asp Lys Tyr Ile Ser Val Gln Tyr 290	295	300	305
agt gct gat gat ctt cag gga aaa gcc gag aac aaa gat gct ata agg Ser Ala Asp Asp Leu Gln Gly Lys Ala Glu Asn Lys Asp Ala Ile Arg 310	315	320	2277
aag cat ctt aaa ctt tcc ttg tca gag ggt tct cga cca ctg gtt gct Lys His Leu Lys Leu Ser Leu Ser Glu Gly Ser Arg Pro Leu Val Ala 325	330	335	2325
tgt att gca cgg ctc gtg cca cag aaa ggt gtg cat ctt atc agg cat Cys Ile Ala Arg Leu Val Pro Gln Lys Gly Val His Leu Ile Arg His 340	345	350	2373
gca ata tat cgt aca ctg gag tta ggt gga caa ttt gtg ctt ctt ggt Ala Ile Tyr Arg Thr Leu Glu Leu Gly Gln Phe Val Leu Leu Gly 355	360	365	2421
gaa agt cca gtc cca cac att cag cgg gag ttt gag gat att gca aag Glu Ser Pro Val Pro His Ile Gln Arg Glu Phe Glu Asp Ile Ala Lys 370	375	380	2469
cat ttc cag agc cac cct cat gtc cgg ttg ctc ttg aaa tac gac gaa His Phe Gln Ser His Pro His Val Arg Leu Leu Lys Tyr Asp Glu			2517

390	395	400	
gcc ctt tca cgc tta att tat gca gca tct gac atg ttt atc att cca Ala Leu Ser Arg Leu Ile Tyr Ala Ala Ser Asp Met Phe Ile Ile Pro 405	410	415	2565
tca atg ttc gag cct tgt ggt ctt acc cag atg att gct atg aga tat Ser Met Phe Glu Pro Cys Gly Leu Thr Gln Met Ile Ala Met Arg Tyr 420	425	430	2613
ggg tct gtg cca att gca aga aaa acc ggt ggg ctc aac gat agt gtc Gly Ser Val Pro Ile Ala Arg Lys Thr Gly Gly Leu Asn Asp Ser Val 435	440	445	2661
ttt gat att gat gat aat atg ata cca gaa caa tac cag aat gga ttt Phe Asp Ile Asp Asp Asn Met Ile Pro Glu Gln Tyr Gln Asn Gly Phe 450	455	460	2709
acg ttt ctg aca acc gat gaa cag ggt cta agc agt gca atg gaa cga Thr Phe Leu Thr Thr Asp Glu Gln Gly Leu Ser Ser Ala Met Glu Arg 470	475	480	2757
gca ttt cgg tac tac act aaa agc cct aag aac tgg caa aat ctt gtt Ala Phe Arg Tyr Tyr Lys Ser Pro Lys Asn Trp Gln Asn Leu Val 485	490	495	2805
cag aag gtt atg aga atg gac ttc agt tgg gat tct tcg gca tcg caa Gln Lys Val Met Arg Met Asp Phe Ser Trp Asp Ser Ser Ala Ser Gln 500	505	510	2853
tat gaa gaa cta tat caa aaa tcc gtg gct aga gca agg gca gca gca Tyr Glu Glu Leu Tyr Gln Lys Ser Val Ala Arg Ala Arg Ala Ala Ala 515	520	525	2901
gcc gct cga gtg taaattcctg ttaaatcccc cctataccgt tccatatcca Ala Ala Arg Val 530			2953
ggggcaaggc ctctctatac acattataaa gtccattttg ctgctgaagc ataaatcatg ggatacactg cagcgctcat atttttatt cctctgccc cccaaatggt acaccgagtg gcaatcatca gtgattgatt aatgatccaa ttcaattgtc gccaactgaa ataatcaagt tggtggatatt caactccacc tcgaagaaca gcggaaagct caatgcacat aatacctgg tccggatatt tgtgaagaag caacaaaagc atgcgccta tcagcaaattg gcatttatga tgcttactcc aagtgcacac aattttaggc aatccacttg ttcatgcatt tccacgagat gctgttgctg tttacatgg tttacatgc agtcatcagt acagatatat cccaacagag tttgactgtt ataagtaatg cgcttattac ttaacgtgt actaaaaaaaaaaaaaaa a			3013 3073 3133 3193 3253 3313 3373 3433 3434
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Leu Lys Asp Trp Leu His Phe Ser Arg Leu Leu Pro Ser His Ala Ser  
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 Val Gly Leu His Ile Ser His Ile Ala Ala Glu Met Ala Pro Ile Ala  
     35                       40                       45  
 Lys Val Gly Gly Leu Gly Asp Val Val Ser Gly Leu Cys Lys Ala Leu  
     50                       55                       60  
 Gln Arg Lys Gly His Leu Val Glu Ile Val Leu Pro Lys Tyr Asp Cys  
     65                       70                       75                       80  
 Met Gln Tyr Asp Leu Val Pro Asp Leu Arg Val Leu Asp Val Ala Val  
     85                       90                       95  
 Glu Ser Tyr Phe Asp Gly Gln Leu Phe Lys Asn Lys Ile Trp Val Ala  
     100                       105                       110  
 Ala Val Glu Gly Leu Pro Val Tyr Phe Ile Glu Pro His His Pro Asp  
     115                       120                       125  
 Lys Leu Phe Trp Arg Gly Lys Tyr Tyr Gly Glu His Asp Asp Phe Lys  
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 Arg Phe Ser Phe Ser Arg Ala Ala Leu Glu Leu Leu Tyr Gln Ala  
     145                       150                       155                       160  
 Gly Lys Lys Pro Asp Ile Ile His Cys His Asp Trp Gln Thr Ala Phe  
     165                       170                       175  
 Val Ala Pro Leu Tyr Trp Asp Ile Tyr Ala Asn Lys Gly Leu Asn Ser  
     180                       185                       190  
 Ala Arg Ile Cys Phe Thr Cys His Asn Phe Glu His Gln Gly Ile Ile  
     195                       200                       205  
 Pro Ala Ser Ala Leu Ala Ser Cys Gly Phe Asp Val His His Met Asn  
     210                       215                       220  
 Arg Asp Arg Met Gln Asp Asn Ser Ala His Asp Arg Val Asn Val Val  
     225                       230                       235                       240  
 Lys Gly Ala Ile Val Phe Ser Asn Ile Val Thr Thr Val Ser Pro Thr  
     245                       250                       255  
 Tyr Ala Gln Glu Ala Cys Thr Ala Glu Gly Arg Gly Leu His Glu  
     260                       265                       270  
 Thr Leu Gln Ser Phe Ser Lys Lys Phe Val Gly Ile Leu Asn Gly Ile  
     275                       280                       285  
 Asp Ala Asp Ala Trp Asn Pro Ser Thr Asp Lys Tyr Ile Ser Val Gln  
     290                       295                       300  
 Tyr Ser Ala Asp Asp Leu Gln Gly Lys Ala Glu Asn Lys Asp Ala Ile  
     305                       310                       315                       320  
 Arg Lys His Leu Lys Leu Ser Leu Ser Glu Gly Ser Arg Pro Leu Val  
     325                       330                       335  
 Ala Cys Ile Ala Arg Leu Val Pro Gln Lys Gly Val His Leu Ile Arg  
     340                       345                       350  
 His Ala Ile Tyr Arg Thr Leu Glu Leu Gly Gly Gln Phe Val Leu Leu  
     355                       360                       365  
 Gly Glu Ser Pro Val Pro His Ile Gln Arg Glu Phe Glu Asp Ile Ala  
     370                       375                       380  
 Lys His Phe Gln Ser His Pro His Val Arg Leu Leu Leu Lys Tyr Asp  
     385                       390                       395                       400  
 Glu Ala Leu Ser Arg Leu Ile Tyr Ala Ala Ser Asp Met Phe Ile Ile  
     405                       410                       415  
 Pro Ser Met Phe Glu Pro Cys Gly Leu Thr Gln Met Ile Ala Met Arg  
     420                       425                       430  
 Tyr Gly Ser Val Pro Ile Ala Arg Lys Thr Gly Gly Leu Asn Asp Ser  
     435                       440                       445  
 Val Phe Asp Ile Asp Asp Asn Met Ile Pro Glu Gln Tyr Gln Asn Gly  
     450                       455                       460

Phe Thr Phe Leu Thr Thr Asp Glu Gln Gly Leu Ser Ser Ala Met Glu  
 465 470 475 480  
 Arg Ala Phe Arg Tyr Tyr Thr Lys Ser Pro Lys Asn Trp Gln Asn Leu  
 485 490 495  
 Val Gln Lys Val Met Arg Met Asp Phe Ser Trp Asp Ser Ser Ala Ser  
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25

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25

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 <212> DNA  
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 <222> (81)...(1928)

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 aatgacgtga gcatattcca atg gct atg acg gca tca cac ttc atc tca  
 Met Ala Ala Met Thr Ala Ser His Phe Ile Ser

60  
113

1 5 10

aat agt tca tgc tcc atc ttc aat gga gct ttt gat tct gtg gtg acg  
 Asn Ser Ser Cys Ser Ile Phe Asn Gly Ala Phe Asp Ser Val Val Thr

161

15 20 25

tct ttc caa agc aga agg att cca ttc tcc agc aac cac act aat aat  
 Ser Phe Gln Ser Arg Arg Ile Pro Phe Ser Ser Asn His Thr Asn Asn

209

30 35 40

tat gaa ggg ctg aga act cggt aat gtg gtg gat tca cgt aaa acg cggt  
 Tyr Glu Gly Leu Arg Thr Arg Asn Val Val Asp Ser Arg Lys Thr Arg

257

45 50 55

atg act gcg aag gca act tct agg cta gct agg agg gtt act cga cat  
 Met Thr Ala Lys Ala Thr Ser Arg Leu Ala Arg Arg Val Thr Arg His

305

60	65	70	75	
gcc agc caa aga ccc ttg att gtt gct gtc tgt gga act gga atg aac Ala Ser Gln Arg Pro Leu Ile Val Ala Val Cys Gly Thr Gly Met Asn				353
80	85	90		
ttg gtg ttt gtt ggt tgt gag gta gct cca tgg agc aaa act ggg ggc Leu Val Phe Val Gly Cys Glu Val Ala Pro Trp Ser Lys Thr Gly Gly				401
95	100	105		
ctt ggc gat gtt ctt aga gga ttg cca cct gct atg gct gca att ggg Leu Gly Asp Val Leu Arg Gly Leu Pro Pro Ala Met Ala Ala Ile Gly				449
110	115	120		
cac agg gtc atg acc gtc gtg cca cga tat gac caa tat aaa gat atc His Arg Val Met Thr Val Val Pro Arg Tyr Asp Gln Tyr Lys Asp Ile				497
125	130	135		
tgg gat aca agt gtc cca gtt gag tta aaa gtt ggg gat aag att gaa Trp Asp Thr Ser Val Pro Val Glu Leu Lys Val Gly Asp Lys Ile Glu				545
140	145	150	155	
act gtc cgc ttc ttc cac tgc tac aaa agg gga gtt gat cgg gtt ttt Thr Val Arg Phe Phe His Cys Tyr Lys Arg Gly Val Asp Arg Val Phe				593
160	165	170		
gtg gat cac cct atg ttt ctc gag aag gtt tgg ggg aaa aca gga gga Val Asp His Pro Met Phe Leu Glu Lys Val Trp Gly Lys Thr Gly Gly				641
175	180	185		
aaa tta tat ggt cct gtt aca gga aca gat tat gca gac aat caa cta Lys Leu Tyr Gly Pro Val Thr Gly Thr Asp Tyr Ala Asp Asn Gln Leu				689
190	195	200		
aga ttc agc ctt ttg tgc ctg gca gct ctg gaa gct cca aga ctt cta Arg Phe Ser Leu Leu Cys Leu Ala Ala Leu Glu Ala Pro Arg Leu Leu				737
205	210	215		
aat ctc aac aac agc aaa tac tat tct gga cca tat gga gat gat gtt Asn Leu Asn Asn Ser Lys Tyr Tyr Ser Gly Pro Tyr Gly Asp Asp Val				785
220	225	230	235	
gtg ttt att gcc aac gat tgg cat tct gct cta ctg ccc tgc tac ttg Val Phe Ile Ala Asn Asp Trp His Ser Ala Leu Leu Pro Cys Tyr Leu				833
240	245	250		
aaa act atg tac caa tca cat ggt att tac atg aat gct aag gtt gca Lys Thr Met Tyr Gln Ser His Gly Ile Tyr Met Asn Ala Lys Val Ala				881
255	260	265		
ttt tgc att cat aat att gct tac cag ggc cga ttt gcc ttt tcg gac Phe Cys Ile His Asn Ile Ala Tyr Gln Gly Arg Phe Ala Phe Ser Asp				929
270	275	280		
ttt gaa ctc ctt aat ctc ccc aat aaa ttt aaa tct tca ttt gat ttc Phe Glu Leu Leu Asn Leu Pro Asn Lys Phe Lys Ser Ser Phe Asp Phe				977

285

290

295

atg gat gga tat gac aaa cct gtg aaa gga agg aaa ata aat tgg atg Met Asp Gly Tyr Asp Lys Pro Val Lys Gly Arg Lys Ile Asn Trp Met 300 305 310 315		1025
aag gct gga ata ata gaa tgt gat agg tgc ttg acc gtg agc cca tat Lys Ala Gly Ile Ile Glu Cys Asp Arg Cys Leu Thr Val Ser Pro Tyr 320 325 330		1073
tat gcc caa gag ctt gtc tca ggg gta gag aag ggt gtt gag ttg ggc Tyr Ala Gln Glu Leu Val Ser Gly Val Glu Lys Gly Val Glu Leu Gly 335 340 345		1121
aat atc ctg cgc atg aaa acc atc tgt gga ata gta aat ggg atg gac Asn Ile Leu Arg Met Lys Thr Ile Cys Gly Ile Val Asn Gly Met Asp 350 355 360		1169
acc acg gag tgg aat cca tta aca gac aaa tat att tct aca aac tac Thr Thr Glu Trp Asn Pro Leu Thr Asp Lys Tyr Ile Ser Thr Asn Tyr 365 370 375		1217
gat gca aca act gta ttg gat gca aaa cct ctc tgt aag gaa gct ttg Asp Ala Thr Thr Val Leu Asp Ala Lys Pro Leu Cys Lys Glu Ala Leu 380 385 390 395		1265
caa gct gag tgt ggg ctg cct gtt aac aaa aac aag ctt gtt ttg gcc Gln Ala Glu Cys Gly Leu Pro Val Asn Lys Asn Lys Leu Val Leu Ala 400 405 410		1313
ttt gtt gga aga cta gat gag cag aaa ggc tca gac att cta gct gca Phe Val Gly Arg Leu Asp Glu Gln Lys Gly Ser Asp Ile Leu Ala Ala 415 420 425		1361
gca att cca gaa ctt ctt tgt gag aat gtt caa gtg ata gta ctt ggc Ala Ile Pro Glu Leu Leu Cys Glu Asn Val Gln Val Ile Val Leu Gly 430 435 440		1409
act ggc aag aag aag ttg gag agt gaa ctt aca tta ctt gag gaa atg Thr Gly Lys Lys Lys Leu Glu Ser Glu Leu Thr Leu Leu Glu Glu Met 445 450 455		1457
ttt cca gac aaa ttc aga gca cat ctc aaa ttc aac gtt cct tta gct Phe Pro Asp Lys Phe Arg Ala His Leu Lys Phe Asn Val Pro Leu Ala 460 465 470 475		1505
cat gca atc atg gca gga gct gat atc ctt gtt att cca agc aga ttc His Ala Ile Met Ala Gly Ala Asp Ile Leu Val Ile Pro Ser Arg Phe 480 485 490		1553
gaa ccc tgt ggc ctc att cag ctt cag gcc atg cga tat gga act ctc Glu Pro Cys Gly Leu Ile Gln Leu Gln Ala Met Arg Tyr Gly Thr Leu 495 500 505		1601
cct atg tgt agc acc act ggt gga ctt gtt gac act gtc aaa gaa ggc Pro Met Cys Ser Thr Thr Gly Gly Leu Val Asp Thr Val Lys Glu Gly		1649

510

515

520

ttc act ggc ttc cat atg ggc ccc ttc agt gtg gag tgt gat gcc gta      1697  
 Phe Thr Gly Phe His Met Gly Pro Phe Ser Val Glu Cys Asp Ala Val  
 525                530                535

gac aaa gct gat gta caa aag att gtc gaa acc acg aaa agg gcc ctc      1745  
 Asp Lys Ala Asp Val Gln Lys Ile Val Glu Thr Thr Lys Arg Ala Leu  
 540                545                550                555

aaa gtc tat gga aca cct gct ttt gtg gag atg atc aag aac tgc atg      1793  
 Lys Val Tyr Gly Thr Pro Ala Phe Val Glu Met Ile Lys Asn Cys Met  
 560                565                570

aac caa gat ctc tca tgg aag gga cct gca aag aag tgg gaa caa ttt      1841  
 Asn Gln Asp Leu Ser Trp Lys Gly Pro Ala Lys Lys Trp Glu Gln Phe  
 575                580                585

ctc ctg agc atg ggg gct gct ggc agt gaa cct gga att gat ggg gag      1889  
 Leu Leu Ser Met Gly Ala Ala Gly Ser Glu Pro Gly Ile Asp Gly Glu  
 590                595                600

gaa ata gct cct ctt gcc aag gaa aat gta gct act cca tgagagatga      1938  
 Glu Ile Ala Pro Leu Ala Lys Glu Asn Val Ala Thr Pro  
 605                610                615

ctaatacttt cctcttagt catagtccta agccttggtg taaagataaa taatcatcct      1998  
 ccaaaacctc catcgacatg atgtatcctt cacgagcttg gataaaattcc aagagtttt  
 atataagcag ttatgtatgc gtcaatctgt atggaaaatc cgtcaatgaa attttttat  
 tgatggctat taatcttagg ccagtattt atgtttgtgt aaaaaaaaaa aaaaaaaaaa      2058      2118      2176

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 Ile Phe Asn Gly Ala Phe Asp Ser Val Val Thr Ser Phe Gln Ser Arg  
 20                25                30  
 Arg Ile Pro Phe Ser Ser Asn His Thr Asn Asn Tyr Glu Gly Leu Arg  
 35                40                45  
 Thr Arg Asn Val Val Asp Ser Arg Lys Thr Arg Met Thr Ala Lys Ala  
 50                55                60  
 Thr Ser Arg Leu Ala Arg Arg Val Thr Arg His Ala Ser Gln Arg Pro  
 65                70                75                80  
 Leu Ile Val Ala Val Cys Gly Thr Gly Met Asn Leu Val Phe Val Gly  
 85                90                95  
 Cys Glu Val Ala Pro Trp Ser Lys Thr Gly Gly Leu Gly Asp Val Leu  
 100                105                110  
 Arg Gly Leu Pro Pro Ala Met Ala Ala Ile Gly His Arg Val Met Thr  
 115                120                125  
 Val Val Pro Arg Tyr Asp Gln Tyr Lys Asp Ile Trp Asp Thr Ser Val  
 130                135                140  
 Pro Val Glu Leu Lys Val Gly Asp Lys Ile Glu Thr Val Arg Phe Phe

145                    150                    155                    160  
 His Cys Tyr Lys Arg Gly Val Asp Arg Val Phe Val Asp His Pro Met  
       165                    170                    175  
 Phe Leu Glu Lys Val Trp Gly Lys Thr Gly Gly Lys Leu Tyr Gly Pro  
       180                    185                    190  
 Val Thr Gly Thr Asp Tyr Ala Asp Asn Gln Leu Arg Phe Ser Leu Leu  
       195                    200                    205  
 Cys Leu Ala Ala Leu Glu Ala Pro Arg Leu Leu Asn Leu Asn Asn Ser  
       210                    215                    220  
 Lys Tyr Tyr Ser Gly Pro Tyr Gly Asp Asp Val Val Phe Ile Ala Asn  
       225                    230                    235                    240  
 Asp Trp His Ser Ala Leu Leu Pro Cys Tyr Leu Lys Thr Met Tyr Gln  
       245                    250                    255  
 Ser His Gly Ile Tyr Met Asn Ala Lys Val Ala Phe Cys Ile His Asn  
       260                    265                    270  
 Ile Ala Tyr Gln Gly Arg Phe Ala Phe Ser Asp Phe Glu Leu Leu Asn  
       275                    280                    285  
 Leu Pro Asn Lys Phe Lys Ser Ser Phe Asp Phe Met Asp Gly Tyr Asp  
       290                    295                    300  
 Lys Pro Val Lys Gly Arg Lys Ile Asn Trp Met Lys Ala Gly Ile Ile  
       305                    310                    315                    320  
 Glu Cys Asp Arg Cys Leu Thr Val Ser Pro Tyr Tyr Ala Gln Glu Leu  
       325                    330                    335  
 Val Ser Gly Val Glu Lys Gly Val Glu Leu Gly Asn Ile Leu Arg Met  
       340                    345                    350  
 Lys Thr Ile Cys Gly Ile Val Asn Gly Met Asp Thr Thr Glu Trp Asn  
       355                    360                    365  
 Pro Leu Thr Asp Lys Tyr Ile Ser Thr Asn Tyr Asp Ala Thr Thr Val  
       370                    375                    380  
 Leu Asp Ala Lys Pro Leu Cys Lys Glu Ala Leu Gln Ala Glu Cys Gly  
       385                    390                    395                    400  
 Leu Pro Val Asn Lys Asn Lys Leu Val Leu Ala Phe Val Gly Arg Leu  
       405                    410                    415  
 Asp Glu Gln Lys Gly Ser Asp Ile Leu Ala Ala Ile Pro Glu Leu  
       420                    425                    430  
 Leu Cys Glu Asn Val Gln Val Ile Val Leu Gly Thr Gly Lys Lys Lys  
       435                    440                    445  
 Leu Glu Ser Glu Leu Thr Leu Leu Glu Met Phe Pro Asp Lys Phe  
       450                    455                    460  
 Arg Ala His Leu Lys Phe Asn Val Pro Leu Ala His Ala Ile Met Ala  
       465                    470                    475                    480  
 Gly Ala Asp Ile Leu Val Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu  
       485                    490                    495  
 Ile Gln Leu Gln Ala Met Arg Tyr Gly Thr Leu Pro Met Cys Ser Thr  
       500                    505                    510  
 Thr Gly Gly Leu Val Asp Thr Val Lys Glu Gly Phe Thr Gly Phe His  
       515                    520                    525  
 Met Gly Pro Phe Ser Val Glu Cys Asp Ala Val Asp Lys Ala Asp Val  
       530                    535                    540  
 Gln Lys Ile Val Glu Thr Thr Lys Arg Ala Leu Lys Val Tyr Gly Thr  
       545                    550                    555                    560  
 Pro Ala Phe Val Glu Met Ile Lys Asn Cys Met Asn Gln Asp Leu Ser  
       565                    570                    575  
 Trp Lys Gly Pro Ala Lys Lys Trp Glu Gln Phe Leu Leu Ser Met Gly  
       580                    585                    590  
 Ala Ala Gly Ser Glu Pro Gly Ile Asp Gly Glu Glu Ile Ala Pro Leu



Val Ile Cys Gly Lys Gly Met Asn Leu Val Phe Val Gly Ala Glu Met			
85	90	95	
gct cca tgg agc aag act gga ggc ctt ggt gat gtt ctt gga gga ctc			453
Ala Pro Trp Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly Gly Leu			
100	105	110	
cca ccg gca ttg gcg gca aat gga cat cga gtt atg gtt ata gcg cca			501
Pro Pro Ala Leu Ala Ala Asn Gly His Arg Val Met Val Ile Ala Pro			
115	120	125	
cgt tat gat caa tac atg gat gct tgg gat aca gat gct ctt gtt gag			549
Arg Tyr Asp Gln Tyr Met Asp Ala Trp Asp Thr Asp Ala Leu Val Glu			
130	135	140	145
ttg aaa gtt ggg gat agg tgt gaa acc gtg cgc ttc ttt cac tgc tat			597
Leu Lys Val Gly Asp Arg Cys Glu Thr Val Arg Phe Phe His Cys Tyr			
150	155	160	
aaa aga gga gtt gat cga gtt ttt gtc gat cac cct atg ttt ctt gcg			645
Lys Arg Gly Val Asp Arg Val Phe Val Asp His Pro Met Phe Leu Ala			
165	170	175	
aag gtc tgg ggg aaa act ggt ggg aag att tat ggt cct aac act gga			693
Lys Val Trp Gly Lys Thr Gly Gly Lys Ile Tyr Gly Pro Asn Thr Gly			
180	185	190	
aca gac tat cag gac aat cag cta cgc ttc agc ttt cta tgc cag gca			741
Thr Asp Tyr Gln Asp Asn Gln Leu Arg Phe Ser Phe Leu Cys Gln Ala			
195	200	205	
gca ttg gaa gct cct aga att cta aat ctc aac aac agt gat tct ttc			789
Ala Leu Glu Ala Pro Arg Ile Leu Asn Leu Asn Asn Ser Asp Ser Phe			
210	215	220	225
tct ggt cct tat ggg gaa gat gtt atc ttc att tgc aat gat tgg cac			837
Ser Gly Pro Tyr Gly Glu Asp Val Ile Phe Ile Cys Asn Asp Trp His			
230	235	240	
act tct ctt ctg cca tgc tac tta aag agc atg tac cat ccc cgt ggc			885
Thr Ser Leu Leu Pro Cys Tyr Leu Lys Ser Met Tyr His Pro Arg Gly			
245	250	255	
att tac aag aac gcc aag gtt gct ttc tgc att cac aat ata tca tac			933
Ile Tyr Lys Asn Ala Lys Val Ala Phe Cys Ile His Asn Ile Ser Tyr			
260	265	270	
caa ggt cga ttt tct ccc tca gac ttc gaa ttt ctc aat ctt ccg gag			981
Gln Gly Arg Phe Ser Pro Ser Asp Phe Glu Phe Leu Asn Leu Pro Glu			
275	280	285	
aat ttc aaa tct tct ttc agt ttc att gat ggg tac aac aag cct gtg			1029
Asn Phe Lys Ser Ser Phe Ser Phe Ile Asp Gly Tyr Asn Lys Pro Val			
290	295	300	305
aag gga atg aag ata aat tgg atg aag gca gga atc tta gaa tca gac			1077

Lys	Gly	Met	Lys	Ile	Asn	Trp	Met	Lys	Ala	Gly	Ile	Leu	Glu	Ser	Asp				
																310	315	320	
agg	gtg	ttt	aca	gtg	agt	cca	tat	tat	gca	caa	gag	ctc	ctt	tca	gga			1125	
Arg	Val	Phe	Thr	Val	Ser	Pro	Tyr	Tyr	Ala	Gln	Glu	Leu	Leu	Ser	Gly				
																325	330	335	
gaa	gaa	agg	gga	gtc	gag	ttg	gac	aac	att	ttg	cgt	gtg	acc	agt	atc			1173	
Glu	Glu	Arg	Gly	Val	Glu	Leu	Asp	Asn	Ile	Leu	Arg	Val	Thr	Ser	Ile				
																340	345	350	
aca	gga	att	gtg	aat	gga	atq	gat	gtt	aat	gag	tgg	aat	cca	tta	aca			1221	
Thr	Gly	Ile	Val	Asn	Gly	Met	Asp	Val	Asn	Glu	Trp	Asn	Pro	Leu	Thr				
																355	360	365	
gac	aag	tat	att	tct	gtt	aat	tat	gat	gca	aaa	cct	gta	atg	gaa	gca			1269	
Asp	Lys	Tyr	Ile	Ser	Val	Asn	Tyr	Asp	Ala	Lys	Pro	Val	Met	Glu	Ala				
																370	375	380	385
aag	cct	ctt	aac	aag	gaa	gca	ttg	caa	gct	gaa	agt	tgg	ctt	gcc	tgt			1317	
Lys	Pro	Leu	Asn	Lys	Glu	Ala	Leu	Gln	Ala	Glu	Ser	Trp	Leu	Ala	Cys				
																390	395	400	
aga	cag	gga	cat	ccc	tgt	aat	tgt	att	cat	gga	aga	cta	gag	gag	cag			1365	
Arg	Gln	Gly	His	Pro	Cys	Asn	Cys	Ile	His	Gly	Arg	Leu	Glu	Glu	Gln				
																405	410	415	
aaa	gga	tca	gat	att	cta	gca	gca	tcc	att	cca	gag	atc	atg	gat	gag			1413	
Lys	Gly	Ser	Asp	Ile	Leu	Ala	Ala	Ser	Ile	Pro	Glu	Ile	Met	Asp	Glu				
																420	425	430	
aat	gtt	cag	cta	att	att	ctt	gga	act	ggc	aag	aag	gaa	atg	gag	aat			1461	
Asn	Val	Gln	Leu	Ile	Ile	Leu	Gly	Thr	Gly	Lys	Lys	Glu	Met	Glu	Asn				
																435	440	445	
cag	ctt	gag	agt	atg	gag	gaa	atg	ttc	ccg	gac	aag	gtg	agg	gca	gtt			1509	
Gln	Leu	Glu	Ser	Met	Glu	Glu	Met	Phe	Pro	Asp	Lys	Val	Arg	Ala	Val				
																450	455	460	465
atg	aag	ttc	aat	gct	ccc	tta	gct	cac	cag	atg	acg	gcg	gga	gct	gat			1557	
Met	Lys	Phe	Asn	Ala	Pro	Leu	Ala	His	Gln	Met	Thr	Ala	Gly	Ala	Asp				
																470	475	480	
ata	att	gtc	att	cca	agt	cga	ttc	gaa	cca	tgc	ggc	ctt	atc	cag	ttg			1605	
Ile	Ile	Val	Ile	Pro	Ser	Arg	Phe	Glu	Pro	Cys	Gly	Leu	Ile	Gln	Leu				
																485	490	495	
caa	ggc	atg	caa	tat	gga	acg	cct	tct	gcg	tgt	tcc	tcc	act	ggt	ggg			1653	
Gln	Gly	Met	Gln	Tyr	Gly	Thr	Pro	Ser	Ala	Cys	Ser	Ser	Thr	Gly	Gly				
																500	505	510	
ctt	gtg	gac	acg	gtg	aaa	gaa	ggc	aaa	act	gga	ttc	cat	atg	gga	cct			1701	
Leu	Val	Asp	Thr	Val	Lys	Glu	Gly	Lys	Thr	Gly	Phe	His	Met	Gly	Pro				
																515	520	525	
ttc	agt	gct	gaa	tgc	gaa	gtg	gtc	gat	ctt	tct	gat	gta	aag	aaa	gtt			1749	

Phe Ser Ala Glu Cys Glu Val Val Asp Leu Ser Asp Val Lys Lys Val			
530	535	540	545
gtc aca act gtg aaa cgc gca ctt aag gtc atc ggc aca cct gcc ttt			1797
Val Thr Thr Val Lys Arg Ala Leu Lys Val Ile Gly Thr Pro Ala Phe			
550	555	560	
gag gat atg atc aag aat tgc atg gca caa gac ctc tca tgg aag ggg			1845
Glu Asp Met Ile Lys Asn Cys Met Ala Gln Asp Leu Ser Trp Lys Gly			
565	570	575	
cct gca aag aac tgg gag caa gtt cta ctg aac ttg gga gtt gcg gga			1893
Pro Ala Lys Asn Trp Glu Gln Val Leu Leu Asn Leu Gly Val Ala Gly			
580	585	590	
agt gaa cca gga tat gat gga gaa gag att gtt cct ctt gct aag gaa			1941
Ser Glu Pro Gly Tyr Asp Gly Glu Glu Ile Val Pro Leu Ala Lys Glu			
595	600	605	
aat gtg gca act cct tgaaattaaa cagctctata atctatgtat aaaccttgcc			1996
Asn Val Ala Thr Pro			
610			
gtggaaaaac ttagtgcatt gtaagtctct tcagggttcc tcctcagcag gaggaaagaa			2056
tatctactgc agaaaagaact atataaatat atatatataat atgataagta atatcttaat			2116
taagaactct ataattgctt gcttcacccataattcgc tgaataaaatc tctcgtaatc			2176
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tctaa			2274
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Ser Ala Ala Asp Ser Asn Pro Arg Ala Phe His Asn Arg Lys Ile Ala			
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Asp Leu Lys Asn Gln Ala Thr Ala Tyr His Gly Leu Arg Ser Gln Asn			
35	40	45	
Ser Val Asp Leu Leu Gln Val Arg Thr Lys Ala Lys Thr Thr Ser Lys			
50	55	60	
Gln Phe Lys Asn Gly Cys Ser Thr Val Asn Leu Arg Pro Pro Arg Ala			
65	70	75	80
Val Val Ile Cys Gly Lys Gly Met Asn Leu Val Phe Val Gly Ala Glu			
85	90	95	
Met Ala Pro Trp Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly Gly			
100	105	110	
Leu Pro Pro Ala Leu Ala Ala Asn Gly His Arg Val Met Val Ile Ala			
115	120	125	
Pro Arg Tyr Asp Gln Tyr Met Asp Ala Trp Asp Thr Asp Ala Leu Val			
130	135	140	
Glu Leu Lys Val Gly Asp Arg Cys Glu Thr Val Arg Phe Phe His Cys			
145	150	155	160
Tyr Lys Arg Gly Val Asp Arg Val Phe Val Asp His Pro Met Phe Leu			

165	170	175
Ala Lys Val Trp Gly Lys Thr Gly	Gly Lys Ile Tyr Gly Pro Asn Thr	
180	185	190
Gly Thr Asp Tyr Gln Asp Asn Gln	Leu Arg Phe Ser Phe Leu Cys Gln	
195	200	205
Ala Ala Leu Glu Ala Pro Arg Ile Leu Asn Leu Asn Asn Ser Asp Ser		
210	215	220
Phe Ser Gly Pro Tyr Gly Glu Asp Val Ile Phe Ile Cys Asn Asp Trp		
225	230	235
His Thr Ser Leu Leu Pro Cys Tyr Leu Lys Ser Met Tyr His Pro Arg		
245	250	255
Gly Ile Tyr Lys Asn Ala Lys Val Ala Phe Cys Ile His Asn Ile Ser		
260	265	270
Tyr Gln Gly Arg Phe Ser Pro Ser Asp Phe Glu Phe Leu Asn Leu Pro		
275	280	285
Glu Asn Phe Lys Ser Ser Phe Ser Phe Ile Asp Gly Tyr Asn Lys Pro		
290	295	300
Val Lys Gly Met Lys Ile Asn Trp Met Lys Ala Gly Ile Leu Glu Ser		
305	310	315
Asp Arg Val Phe Thr Val Ser Pro Tyr Tyr Ala Gln Glu Leu Leu Ser		
325	330	335
Gly Glu Glu Arg Gly Val Glu Leu Asp Asn Ile Leu Arg Val Thr Ser		
340	345	350
Ile Thr Gly Ile Val Asn Gly Met Asp Val Asn Glu Trp Asn Pro Leu		
355	360	365
Thr Asp Lys Tyr Ile Ser Val Asn Tyr Asp Ala Lys Pro Val Met Glu		
370	375	380
Ala Lys Pro Leu Asn Lys Glu Ala Leu Gln Ala Glu Ser Trp Leu Ala		
385	390	395
Cys Arg Gln Gly His Pro Cys Asn Cys Ile His Gly Arg Leu Glu Glu		
405	410	415
Gln Lys Gly Ser Asp Ile Leu Ala Ala Ser Ile Pro Glu Ile Met Asp		
420	425	430
Glu Asn Val Gln Leu Ile Ile Leu Gly Thr Gly Lys Lys Glu Met Glu		
435	440	445
Asn Gln Leu Glu Ser Met Glu Glu Met Phe Pro Asp Lys Val Arg Ala		
450	455	460
Val Met Lys Phe Asn Ala Pro Leu Ala His Gln Met Thr Ala Gly Ala		
465	470	475
Asp Ile Ile Val Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu Ile Gln		
485	490	495
Leu Gln Gly Met Gln Tyr Gly Thr Pro Ser Ala Cys Ser Ser Thr Gly		
500	505	510
Gly Leu Val Asp Thr Val Lys Glu Gly Lys Thr Gly Phe His Met Gly		
515	520	525
Pro Phe Ser Ala Glu Cys Glu Val Val Asp Leu Ser Asp Val Lys Lys		
530	535	540
Val Val Thr Thr Val Lys Arg Ala Leu Lys Val Ile Gly Thr Pro Ala		
545	550	555
Phe Glu Asp Met Ile Lys Asn Cys Met Ala Gln Asp Leu Ser Trp Lys		
565	570	575
Gly Pro Ala Lys Asn Trp Glu Gln Val Leu Leu Asn Leu Gly Val Ala		
580	585	590
Gly Ser Glu Pro Gly Tyr Asp Gly Glu Glu Ile Val Pro Leu Ala Lys		
595	600	605
Glu Asn Val Ala Thr Pro		

610

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Ala Thr Thr Ala Ala Pro His Phe Ile Ile Ser Lys Ser Trp Tyr  
5 10 15

gag ttg gag cca aaa ggg ttc atc aag agt ttg agc aac cca tcc ccc 156  
Glu Leu Glu Pro Lys Gly Phe Ile Lys Ser Leu Ser Asn Pro Ser Pro  
20 25 30

ggc ttc cgc ggt ctg aga cct ctg aag ccg gtg ggt tcg ctg cag atg 204  
Gly Phe Arg Gly Leu Arg Pro Leu Lys Pro Val Gly Ser Leu Gln Met  
35 40 45

cga ctc aac acg aaa tca acc ccc aaa gtt ggt agc tct gtc gtt gcg 252  
Arg Leu Asn Thr Lys Ser Thr Pro Lys Val Gly Ser Ser Val Val Ala  
50 55 60 65

cct acg gtc gaa act aca ggg atg aac ctg gtg ttc gtc ggg acc gag 300  
Pro Thr Val Glu Thr Thr Gly Met Asn Leu Val Phe Val Gly Thr Glu  
70 75 80

acg ggt ccg tac agc aag acc ggc ggg ctc ggg gat gtg cta gga ggg 348  
Thr Gly Pro Tyr Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly Gly  
85 90 95

tta ccg ccc gcc ctg gcg gcg aga ggg cat	cgg gtc atg gtt gtc act	396
Leu Pro Pro Ala Leu Ala Ala Arg Gly His	Arg Val Met Val Val Thr	
100	105	110
ccg cgg tac gat cag tac aag gat	gca tgg gac aca aac act gtg ctt	444
Pro Arg Tyr Asp Gln Tyr Lys Asp Ala Trp	Asp Thr Asn Thr Val Leu	
115	120	125
gag atc aaa gtc ggg gat aaa atg gag acg	gtt cgt ttc ttc cac ctc	492
Glu Ile Lys Val Gly Asp Lys Met Glu	Thr Val Arg Phe Phe His	
130	135	140
cat aag agg ggg gtg gat agg gtg ttt att	gat cac cct tgg ttt ctt	540
His Lys Arg Gly Val Asp Arg Val Phe	Ile Asp His Pro Trp Phe Leu	
150	155	160
gag aag gtt tgg ggg aaa acc ggt ggg	aaa ttg tat ggt cct gtt act	588
Glu Lys Val Trp Gly Lys Thr Gly	Lys Leu Tyr Gly Pro Val Thr	
165	170	175
gga act gat tat gat gat aac cag cta	cgg ttc agt ctt ctg tgt cag	636
Gly Thr Asp Tyr Asp Asp Asn Gln	Leu Arg Phe Ser Leu Leu Cys Gln	
180	185	190
gct gct ttg gag gct cca aga gtt cta	aat ctc aac aac agt aaa tat	684
Ala Ala Leu Glu Ala Pro Arg Val Leu	Asn Leu Asn Ser Lys Tyr	
195	200	205
ttt tct gga cca tat ggt gaa gat	gtc gtt ttt att gcg aac gat tgg	732
Phe Ser Gly Pro Tyr Gly Glu Asp Val	Val Phe Ile Ala Asn Asp Trp	
210	215	220
cac act gga cct ctt cca tgc tac	ttg aag agt gtg tat aaa tca gaa	780
His Thr Gly Pro Leu Pro Cys Tyr	Leu Lys Ser Val Tyr Lys Ser Glu	
230	235	240
gga tta tat gag agt gcc aag gtt	gcc ttt tgc att cat aat atg gca	828
Gly Leu Tyr Glu Ser Ala Lys Val	Ala Phe Cys Ile His Asn Met Ala	
245	250	255
tac caa ggc aga ttc gcc ttt cct	gat ttc tcg ctt ctc aac ctt cca	876
Tyr Gln Gly Arg Phe Ala Phe Pro	Asp Phe Ser Leu Leu Asn Leu Pro	
260	265	270
gac aca ttt aaa tcc tcg ttt gat	ttc ttc gat gga tat aca aaa cct	924
Asp Thr Phe Lys Ser Ser Phe Asp	Phe Phe Asp Gly Tyr Thr Lys Pro	
275	280	285
gtg aaa ggt aga aaa ata aat	tgg atg aag gct gga ata ttg gaa gcg	972
Val Lys Gly Arg Lys Ile Asn Trp Met	Lys Ala Gly Ile Leu Glu Ala	
290	295	300
gac act gtt gta act gtg agc ccg	tat tat gct aaa gag ctc gtc tct	1020
Asp Thr Val Val Thr Val Ser Pro	Tyr Tyr Ala Lys Glu Leu Val Ser	
310	315	320

gga gaa gat aga ggt gtc gag ttg gac aac gtt ctg cgc ttg agg ggc Gly Glu Asp Arg Gly Val Glu Leu Asp Asn Val Leu Arg Leu Arg Gly	325	330	335	1068
gtc aaa gga att gtg aat ggg atg gat act aat gtg tgg aat cca ttg Val Lys Gly Ile Val Asn Gly Met Asp Thr Asn Val Trp Asn Pro Leu	340	345	350	1116
aca gac aaa ttt atc act gca aat tac gat gca aca atg gta aca gag Thr Asp Lys Phe Ile Thr Ala Asn Tyr Asp Ala Thr Met Val Thr Glu	355	360	365	1164
gca aaa cgt gtt aat aag caa gaa tta caa gca gaa gtt ggc ttg cct Ala Lys Arg Val Asn Lys Gln Glu Leu Gln Ala Glu Val Gly Leu Pro	370	375	380	385
gta gat cca gac att cct gtt ata gtt ttt gtt gga agg ctg gag gag Val Asp Pro Asp Ile Pro Val Ile Val Phe Val Gly Arg Leu Glu Glu	390	395	400	1260
cag aaa ggt tca gat att cta gct gca gca att cca gaa tta atg gat Gln Lys Gly Ser Asp Ile Leu Ala Ala Ile Pro Glu Leu Met Asp	405	410	415	1308
gag aac gtt cag atc ata att ctt gga act ggc aag aaa cac ctc gaa Glu Asn Val Gln Ile Ile Leu Gly Thr Gly Lys Lys His Leu Glu	420	425	430	1356
aag gag ctt gaa gaa ata gaa gaa caa ttt cca gac aag atg aga ctt Lys Glu Leu Glu Glu Ile Glu Glu Gln Phe Pro Asp Lys Met Arg Leu	435	440	445	1404
gtt gcg aaa ttc aat gtt ccg ttg gct cat atg atg atg gct gga ggt Val Ala Lys Phe Asn Val Pro Leu Ala His Met Met Met Ala Gly Gly	450	455	460	465
gat ttt ata ata att cct agt aga ttt gag ccg tgt ggg ctt att cag Asp Phe Ile Ile Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu Ile Gln	470	475	480	1500
ctt gaa ggc atg aaa tat ggg atg cca gcc ata tgt tcc acc acc ggt Leu Glu Gly Met Lys Tyr Gly Met Pro Ala Ile Cys Ser Thr Thr Gly	485	490	495	1548
ggt ctt gta gac aca atc agg gaa ggc ttc acc gga ttt cac atg ggt Gly Leu Val Asp Thr Ile Arg Glu Gly Phe Thr Gly Phe His Met Gly	500	505	510	1596
gcc ttc act gtt gag tgt gaa act gtt gat ccg gtg gat gtg gcg gga Ala Phe Thr Val Glu Cys Glu Thr Val Asp Pro Val Asp Val Ala Gly	515	520	525	1644
att gtt aaa act gta aag agg gcc ctt aag gtc tat gga act cca gcc Ile Val Lys Thr Val Lys Arg Ala Leu Lys Val Tyr Gly Thr Pro Ala	530	535	540	1692
			545	

ttc agc gaa atg gtt cag aac tgc atg gct caa gat cac tca tgg aag Phe Ser Glu Met Val Gln Asn Cys Met Ala Gln Asp His Ser Trp Lys	550	555	560	1740
gaa cct gca aaa aaa tgg gaa gag cta ctc ctg gga ctg gaa gtc gac Glu Pro Ala Lys Lys Trp Glu Glu Leu Leu Leu Gly Leu Glu Val Asp	565	570	575	1788
ggc agc gaa cct ggg ttt gat ggg gag gaa att gct cct ctt gca aag Gly Ser Glu Pro Gly Phe Asp Gly Glu Glu Ile Ala Pro Leu Ala Lys	580	585	590	1836
gaa aat gtg gct gct cca ttc tagtgatctg tatgccgtct tcaagccatc Glu Asn Val Ala Ala Pro Phe	595	600		1887
tcatgctaac atcctttagt cataaaattta ttttatttagt agcccttccc ttatgttcag tgcttctatg ttatgttgtt atcattcatg agatgtataa ttctcggtgg aagtccagac				1947
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				2067
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Met Ala Thr Thr Ala Ala Pro His Phe Ile Ile Ser Lys Ser Trp	1	5	10	15
Tyr Glu Leu Glu Pro Lys Gly Phe Ile Lys Ser Leu Ser Asn Pro Ser	20	25	30	
Pro Gly Phe Arg Gly Leu Arg Pro Leu Lys Pro Val Gly Ser Leu Gln	35	40	45	
Met Arg Leu Asn Thr Lys Ser Thr Pro Lys Val Gly Ser Ser Val Val	50	55	60	
Ala Pro Thr Val Glu Thr Thr Gly Met Asn Leu Val Phe Val Gly Thr	65	70	75	80
Glu Thr Gly Pro Tyr Ser Lys Thr Gly Gly Leu Gly Asp Val Leu Gly	85	90	95	
Gly Leu Pro Pro Ala Leu Ala Ala Arg Gly His Arg Val Met Val Val	100	105	110	
Thr Pro Arg Tyr Asp Gln Tyr Lys Asp Ala Trp Asp Thr Asn Thr Val	115	120	125	
Leu Glu Ile Lys Val Gly Asp Lys Met Glu Thr Val Arg Phe Phe His	130	135	140	
Leu His Lys Arg Gly Val Asp Arg Val Phe Ile Asp His Pro Trp Phe	145	150	155	160
Leu Glu Lys Val Trp Gly Lys Thr Gly Gly Lys Leu Tyr Gly Pro Val	165	170	175	
Thr Gly Thr Asp Tyr Asp Asp Asn Gln Leu Arg Phe Ser Leu Leu Cys	180	185	190	
Gln Ala Ala Leu Glu Ala Pro Arg Val Leu Asn Leu Asn Asn Ser Lys	195	200	205	
Tyr Phe Ser Gly Pro Tyr Gly Glu Asp Val Val Phe Ile Ala Asn Asp	210	215	220	
Trp His Thr Gly Pro Leu Pro Cys Tyr Leu Lys Ser Val Tyr Lys Ser	225	230	235	240

Glu Gly Leu Tyr Glu Ser Ala Lys Val Ala Phe Cys Ile His Asn Met  
           245                 250                 255  
 Ala Tyr Gln Gly Arg Phe Ala Phe Pro Asp Phe Ser Leu Leu Asn Leu  
           260                 265                 270  
 Pro Asp Thr Phe Lys Ser Ser Phe Asp Phe Phe Asp Gly Tyr Thr Lys  
           275                 280                 285  
 Pro Val Lys Gly Arg Lys Ile Asn Trp Met Lys Ala Gly Ile Leu Glu  
           290                 295                 300  
 Ala Asp Thr Val Val Thr Val Ser Pro Tyr Tyr Ala Lys Glu Leu Val  
           305                 310                 315                 320  
 Ser Gly Glu Asp Arg Gly Val Glu Leu Asp Asn Val Leu Arg Leu Arg  
           325                 330                 335  
 Gly Val Lys Gly Ile Val Asn Gly Met Asp Thr Asn Val Trp Asn Pro  
           340                 345                 350  
 Leu Thr Asp Lys Phe Ile Thr Ala Asn Tyr Asp Ala Thr Met Val Thr  
           355                 360                 365  
 Glu Ala Lys Arg Val Asn Lys Gln Glu Leu Gln Ala Glu Val Gly Leu  
           370                 375                 380  
 Pro Val Asp Pro Asp Ile Pro Val Ile Val Phe Val Gly Arg Leu Glu  
           385                 390                 395                 400  
 Glu Gln Lys Gly Ser Asp Ile Leu Ala Ala Ile Pro Glu Leu Met  
           405                 410                 415  
 Asp Glu Asn Val Gln Ile Ile Leu Gly Thr Gly Lys Lys His Leu  
           420                 425                 430  
 Glu Lys Glu Leu Glu Glu Ile Glu Glu Gln Phe Pro Asp Lys Met Arg  
           435                 440                 445  
 Leu Val Ala Lys Phe Asn Val Pro Leu Ala His Met Met Met Ala Gly  
           450                 455                 460  
 Gly Asp Phe Ile Ile Ile Pro Ser Arg Phe Glu Pro Cys Gly Leu Ile  
           465                 470                 475                 480  
 Gln Leu Glu Gly Met Lys Tyr Gly Met Pro Ala Ile Cys Ser Thr Thr  
           485                 490                 495  
 Gly Gly Leu Val Asp Thr Ile Arg Glu Gly Phe Thr Gly Phe His Met  
           500                 505                 510  
 Gly Ala Phe Thr Val Glu Cys Glu Thr Val Asp Pro Val Asp Val Ala  
           515                 520                 525  
 Gly Ile Val Lys Thr Val Lys Arg Ala Leu Lys Val Tyr Gly Thr Pro  
           530                 535                 540  
 Ala Phe Ser Glu Met Val Gln Asn Cys Met Ala Gln Asp His Ser Trp  
           545                 550                 555                 560  
 Lys Glu Pro Ala Lys Lys Trp Glu Glu Leu Leu Leu Gly Leu Glu Val  
           565                 570                 575  
 Asp Gly Ser Glu Pro Gly Phe Asp Gly Glu Glu Ile Ala Pro Leu Ala  
           580                 585                 590  
 Lys Glu Asn Val Ala Ala Pro Phe  
           595                 600

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 atggctacca cgacggccgc tccgc

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Met Ser Val Gly Lys Ala Arg Ser Phe Arg Val Arg Lys Arg Glu Ser			
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ttg gtg ggt ctg cga gcc act ggg aaa agt ggt agc ttt gaa gag gaa			96
Leu Val Gly Leu Arg Ala Thr Gly Lys Ser Gly Ser Phe Glu Glu Glu			
20 25 30			
ggg gag gag aga gag ggt gtt ggt cgt gcg ggt gtt gat gat gct			144
Gly Glu Arg Glu Gly Val Gly Arg Ala Gly Val Gly Asp Asp Ala			
35 40 45			
ctt cgt gca acg att gat aag agc aat gag att ctt gca atc cac agt			192
Leu Arg Ala Thr Ile Asp Lys Ser Asn Glu Ile Leu Ala Ile His Ser			
50 55 60			
aac cta ctt caa cag att gca aaa aga aag aat att gtt tca tca atc			240
Asn Leu Leu Gln Gln Ile Ala Lys Arg Lys Asn Ile Val Ser Ser Ile			
65 70 75 80			
aga agt gac gta act aag gaa aat gat tca agt tct tat gtt gag			288
Arg Ser Asp Val Thr Lys Glu Glu Asn Asp Ser Ser Ser Tyr Val Glu			
85 90 95			
aag gaa aat ttg gag cca agc agt gga gag caa aat ggg aag tac aaa			336
Lys Glu Asn Leu Glu Pro Ser Ser Gly Glu Gln Asn Gly Lys Tyr Lys			
100 105 110			
agc ggc gcc gtt cct aat aat tat tcc caa ttg gct caa gat gat aca			384
Ser Gly Ala Val Pro Asn Asn Tyr Ser Gln Leu Ala Gln Asp Asp Thr			
115 120 125			
tct gag aat cca ctt gtt aat tcc ttt gga ggt tct cca aaa gat aac			432
Ser Glu Asn Pro Leu Val Asn Ser Phe Gly Gly Ser Pro Lys Asp Asn			
130 135 140			
gta gaa gct gtt gaa ttt cag gtg aga caa tca gca gta gat gct ttt			480
Val Glu Ala Val Glu Phe Gln Val Arg Gln Ser Ala Val Asp Ala Phe			
145 150 155 160			



aaa tat gct cgg tct gtt ctg gta ata cac aac ata gcc cac cag ggt      1200  
 Lys Tyr Ala Arg Ser Val Leu Val Ile His Asn Ile Ala His Gln Gly  
 385                    390                    395                    400  
  
 cgt ggt cct gta gat gac ttc aaa ttt gtg ggc ttg ccg gat cac tac      1248  
 Arg Gly Pro Val Asp Asp Phe Lys Phe Val Gly Leu Pro Asp His Tyr  
 405                    410                    415  
  
 ttg gac ctt ttc aga ttg tat gac ccc gtc gga ggt gaa cac ctc aat      1296  
 Leu Asp Leu Phe Arg Leu Tyr Asp Pro Val Gly Gly Glu His Leu Asn  
 420                    425                    430  
  
 att ttt gct gct ggc ctg aag act gct gac cga gtg gtt act gtt agc      1344  
 Ile Phe Ala Ala Gly Leu Lys Thr Ala Asp Arg Val Val Thr Val Ser  
 435                    440                    445  
  
 cat ggt tat gca tgg gag ctg aaa aca tca gaa ggt ggt tgg ggc cta      1392  
 His Gly Tyr Ala Trp Glu Leu Lys Thr Ser Glu Gly Gly Trp Gly Leu  
 450                    455                    460  
  
 cat gaa att ata aat gaa agt aac tgg aag ttt caa ggt att gta aat      1440  
 His Glu Ile Ile Asn Glu Ser Asn Trp Lys Phe Gln Gly Ile Val Asn  
 465                    470                    475                    480  
  
 ggc att gat gca aag gag tgg agc ccc gaa ttt gat gtg cac ctt aaa      1488  
 Gly Ile Asp Ala Lys Glu Trp Ser Pro Glu Phe Asp Val His Leu Lys  
 485                    490                    495  
  
 tcc gat gga tac aca aat tat tct cta gat act tta gag atg ggt aag      1536  
 Ser Asp Gly Tyr Thr Asn Tyr Ser Leu Asp Thr Leu Glu Met Gly Lys  
 500                    505                    510  
  
 cca gta tgt aag gct gct ttg cag cga gag gtc ggt ctg cct gtt cgt      1584  
 Pro Val Cys Lys Ala Ala Leu Gln Arg Glu Val Gly Leu Pro Val Arg  
 515                    520                    525  
  
 gat aat gta ccc atc att gca ttc att gga agg tta gac cac cag aaa      1632  
 Asp Asn Val Pro Ile Ile Ala Phe Ile Gly Arg Leu Asp His Gln Lys  
 530                    535                    540  
  
 ggc gtc gat ctc att gcc gag gcc atg cct tgg att gtc agt cat gat      1680  
 Gly Val Asp Leu Ile Ala Glu Ala Met Pro Trp Ile Val Ser His Asp  
 545                    550                    555                    560  
  
 gtt caa gta gtc atg tta ggc acg ggg agg caa gac ctt gag aat tta      1728  
 Val Gln Val Val Met Leu Gly Thr Gly Arg Gln Asp Leu Glu Asn Leu  
 565                    570                    575  
  
 ctg agg aac ttt gag ggt caa cac agg gac aaa gtt aga gca tgg gtt      1776  
 Leu Arg Asn Phe Glu Gly Gln His Arg Asp Lys Val Arg Ala Trp Val  
 580                    585                    590  
  
 gca ttt tca gta aag atg gcg cat aga att aca gca ggt gcc gac atc      1824  
 Ala Phe Ser Val Lys Met Ala His Arg Ile Thr Ala Gly Ala Asp Ile  
 595                    600                    605

ctc atg atg cct tcg agg ttt gag cca tgc gga ttg aac cag ctt tac Leu Met Met Pro Ser Arg Phe Glu Pro Cys Gly Leu Asn Gln Leu Tyr 610                   615                   620	1872
gca atg atg tat gga acc att cca gtg gtg cat gct gtt ggg ggc ctt Ala Met Met Tyr Gly Thr Ile Pro Val Val His Ala Val Gly Gly Leu 625                   630                   635                   640	1920
aga gat aca gtg actcaa ttt gat cct ttc aac gag tct ggt ctt ggt Arg Asp Thr Val Thr Gln Phe Asp Pro Phe Asn Glu Ser Gly Leu Gly 645                   650                   655	1968
tgg acc ttc gac agg gca gag gca gga aag ctg atc cat gca ttg aat Trp Thr Phe Asp Arg Ala Glu Ala Gly Lys Leu Ile His Ala Leu Asn 660                   665                   670	2016
aac tgc ttg aat aca tac tgg aat tac aag gac agt tgg aag ggt ctt Asn Cys Leu Asn Thr Tyr Trp Asn Tyr Lys Asp Ser Trp Lys Gly Leu 675                   680                   685	2064
caa aca aga ggg atg atg caa gat ctt agc tgg gat aat gct gct cag Gln Thr Arg Gly Met Met Gln Asp Leu Ser Trp Asp Asn Ala Ala Gln 690                   695                   700	2112
caa tac gag gat gtc ctt gtt gca gcc aag tac caa tgg tga ttc ttc Gln Tyr Glu Asp Val Leu Val Ala Ala Lys Tyr Gln Trp * Phe Phe 705                   710                   715	2160
tcc atc aca tgt gtg tta att gag atc tat cga gag atg atg ata atg Ser Ile Thr Cys Val Leu Ile Glu Ile Tyr Arg Glu Met Met Ile Met 720                   725                   730                   735	2208
gtc tat atg tga gat cat agt ttc aga tat gcg gca gca tgc aaa tag Val Tyr Met * Asp His Ser Phe Arg Tyr Ala Ala Ala Cys Lys *	2256
740                   745	
atg aaa ttt ttt tgg ctc atg ctg gaa cat gta aat tgt ttc tct ttt Met Lys Phe Phe Trp Leu Met Leu Glu His Val Asn Cys Phe Ser Phe 750                   755                   760                   765	2304
ttt cca ttt ttg ccc tgc act ctg tac aga gga agg agg aaa caa ttg Phe Pro Phe Leu Pro Cys Thr Leu Tyr Arg Gly Arg Arg Lys Gln Leu 770                   775                   780	2352
ctg aaa act gtg gag gtc tgt gta ccc tat att tct agc ttt tat taa Leu Lys Thr Val Glu Val Cys Val Pro Tyr Ile Ser Ser Phe Tyr *	2400
785                   790                   795	
tgc aag tag ttc ttc gtt Cys Lys * Phe Phe Val 800	2418

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<211> 801

<212> PRT

<213> Typha latifolia

<400> 26

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Gly Glu Glu Arg Glu Gly Val Gly Arg Ala Gly Val Gly Asp Asp Ala  
35 40 45  
Leu Arg Ala Thr Ile Asp Lys Ser Asn Glu Ile Leu Ala Ile His Ser  
50 55 60  
Asn Leu Leu Gln Gln Ile Ala Lys Arg Lys Asn Ile Val Ser Ser Ile  
65 70 75 80  
Arg Ser Asp Val Thr Lys Glu Glu Asn Asp Ser Ser Ser Tyr Val Glu  
85 90 95  
Lys Glu Asn Leu Glu Pro Ser Ser Gly Glu Gln Asn Gly Lys Tyr Lys  
100 105 110  
Ser Gly Ala Val Pro Asn Asn Tyr Ser Gln Leu Ala Gln Asp Asp Thr  
115 120 125  
Ser Glu Asn Pro Leu Val Asn Ser Phe Gly Gly Ser Pro Lys Asp Asn  
130 135 140  
Val Glu Ala Val Glu Phe Gln Val Arg Gln Ser Ala Val Asp Ala Phe  
145 150 155 160  
Gly Arg Pro Glu Glu Pro Ser Leu Gly Thr Thr Lys Ile Leu Ser Pro  
165 170 175  
Phe Tyr Leu Glu Ala Glu Ser Asp Gly Ala Lys Glu Glu Asn Ala Glu  
180 185 190  
Asp Leu Val Glu Ala Lys Leu Asp Ser Val His Val Lys Asp Asp Leu  
195 200 205  
Asn Pro Gly Glu Glu Asn Glu Val Pro Leu Pro Leu Ala Gly Ala Asn  
210 215 220  
Val Met Asn Ile Ile Val Val Ala Ala Glu Cys Ala Pro Trp Ser Lys  
225 230 235 240  
Thr Gly Gly Leu Gly Asp Val Ala Gly Ala Leu Pro Lys Ala Leu Ala  
245 250 255  
Arg Arg Gly His Arg Val Met Val Val Ala Pro Arg Tyr Gly Asn Tyr  
260 265 270  
Ala Glu Pro Gln Asp Ile Gly Val Arg Lys Tyr Tyr Lys Val His Gly  
275 280 285  
Gln Asp Met Glu Val Thr Tyr Phe His Ala Tyr Ile Asp Gly Val Asp  
290 295 300  
Phe Val Phe Met Asp Ser Pro Asp Phe Arg His Arg Gly Asn Arg Ile  
305 310 315 320  
Tyr Glu Gly Asn Arg Val Asp Ile Leu Lys Arg Met Ile Leu Phe Cys  
325 330 335  
Lys Ala Ala Val Glu Val Pro Trp His Val Pro Cys Gly Gly Phe Cys  
340 345 350  
Tyr Gly Asp Gly Asn Leu Ala Phe Ile Thr Asn Asp Trp His Thr Ala  
355 360 365  
Leu Leu Pro Val Tyr Leu Lys Ala Tyr Tyr Arg Asp Asn Gly Leu Met  
370 375 380  
Lys Tyr Ala Arg Ser Val Leu Val Ile His Asn Ile Ala His Gln Gly  
385 390 395 400  
Arg Gly Pro Val Asp Asp Phe Lys Phe Val Gly Leu Pro Asp His Tyr  
405 410 415

Leu Asp Leu Phe Arg Leu Tyr Asp Pro Val Gly Gly Glu His Leu Asn  
     420                  425                  430  
 Ile Phe Ala Ala Gly Leu Lys Thr Ala Asp Arg Val Val Thr Val Ser  
     435                  440                  445  
 His Gly Tyr Ala Trp Glu Leu Lys Thr Ser Glu Gly Gly Trp Gly Leu  
     450                  455                  460  
 His Glu Ile Ile Asn Glu Ser Asn Trp Lys Phe Gln Gly Ile Val Asn  
     465                  470                  475                  480  
 Gly Ile Asp Ala Lys Glu Trp Ser Pro Glu Phe Asp Val His Leu Lys  
     485                  490                  495  
 Ser Asp Gly Tyr Thr Asn Tyr Ser Leu Asp Thr Leu Glu Met Gly Lys  
     500                  505                  510  
 Pro Val Cys Lys Ala Ala Leu Gln Arg Glu Val Gly Leu Pro Val Arg  
     515                  520                  525  
 Asp Asn Val Pro Ile Ile Ala Phe Ile Gly Arg Leu Asp His Gln Lys  
     530                  535                  540  
 Gly Val Asp Leu Ile Ala Glu Ala Met Pro Trp Ile Val Ser His Asp  
     545                  550                  555                  560  
 Val Gln Val Val Met Leu Gly Thr Gly Arg Gln Asp Leu Glu Asn Leu  
     565                  570                  575  
 Leu Arg Asn Phe Glu Gly Gln His Arg Asp Lys Val Arg Ala Trp Val  
     580                  585                  590  
 Ala Phe Ser Val Lys Met Ala His Arg Ile Thr Ala Gly Ala Asp Ile  
     595                  600                  605  
 Leu Met Met Pro Ser Arg Phe Glu Pro Cys Gly Leu Asn Gln Leu Tyr  
     610                  615                  620  
 Ala Met Met Tyr Gly Thr Ile Pro Val Val His Ala Val Gly Gly Leu  
     625                  630                  635                  640  
 Arg Asp Thr Val Thr Gln Phe Asp Pro Phe Asn Glu Ser Gly Leu Gly  
     645                  650                  655  
 Trp Thr Phe Asp Arg Ala Glu Ala Gly Lys Leu Ile His Ala Leu Asn  
     660                  665                  670  
 Asn Cys Leu Asn Thr Tyr Trp Asn Tyr Lys Asp Ser Trp Lys Gly Leu  
     675                  680                  685  
 Gln Thr Arg Gly Met Met Gln Asp Leu Ser Trp Asp Asn Ala Ala Gln  
     690                  695                  700  
 Gln Tyr Glu Asp Val Leu Val Ala Ala Lys Tyr Gln Trp Phe Phe Ser  
     705                  710                  715                  720  
 Ile Thr Cys Val Leu Ile Glu Ile Tyr Arg Glu Met Met Ile Met Val  
     725                  730                  735  
 Tyr Met Asp His Ser Phe Arg Tyr Ala Ala Ala Cys Lys Met Lys Phe  
     740                  745                  750  
 Phe Trp Leu Met Leu Glu His Val Asn Cys Phe Ser Phe Phe Pro Phe  
     755                  760                  765  
 Leu Pro Cys Thr Leu Tyr Arg Gly Arg Arg Lys Gln Leu Leu Lys Thr  
     770                  775                  780  
 Val Glu Val Cys Val Pro Tyr Ile Ser Ser Phe Tyr Cys Lys Phe Phe  
     785                  790                  795                  800  
 Val

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 <213> Typha latifolia

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23

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<213> *Typha latifolia*

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24